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Holistic versus detailed visual processing in body dysmorphic disorder: Testing the inversion, composite and global precedence effects

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ABSTRACT

Individuals with Body Dysmorphic Disorder (BDD) are preoccupied with perceived defects in their appearance that are not visible to others. An excessive focus and processing of details has been proposed as a possible mechanism underlying this distorted self-image in BDD. The nature and extent of visuoperceptual abnormalities in BDD however require further investigation; specifically, it remains unclear whether feature-based processing in BDD is a result of a failure of holistic perceptual processes. The present study evaluated whether BDD is associated with an impairment in global processing. Twenty-five individuals with a primary diagnosis of BDD (15 unmedicated, 10 medicated) and 25 matched healthy controls were administered three robust behavioural tasks that test holistic encoding, namely the face inversion, the composite and the navon tasks. Overall, individuals in the BDD and control groups performed similarly in all aspects of holistic processing tested. Our findings suggest that the excessive focus on specific aspects of appearance in BDD may not be explained by impairments in the global encoding of visual information. Implications of these results and suggestions for future research on visual processing in BDD are discussed.

1. Introduction

Body Dysmorphic Disorder (BDD) is a psychiatric condition marked by an excessive preoccupation with a perceived defect in physical appearance, leading to significant distress and/or functional impairment (American Psychiatric Association, 2000). BDD is relatively common, with prevalence estimates ranging between 1 and 2% in the general population (Rief et al., 2006; Koran et al., 2008; Buhlmann et al., 2010). The symptoms of BDD have been associated with substantial psychiatric comorbidity (Gunstad and Phillips, 2003; Pavan et al., 2008), poor quality of life (Didie et al., 2007) and alarmingly high suicide rates (Phillips et al., 2005a). Although studies have shown BDD to be a familial and moderately heritable disorder (Monzani et al., 2012a), with close etiological links with Obsessive-Compulsive Disorder (OCD) (Bienvenu et al., 2012; Monzani et al., 2012b), at present its precise aetiology remains largely unknown.

Abnormalities in visual processing have been proposed as a putative mechanism underlying the distorted perception of appearance that is a cardinal feature of BDD. Indeed, clinical observations, patient descriptions (Silver and Reavey, 2010) and eye tracking experiments (Grocholewski et al., 2012) suggest that individuals with BDD over focus on minor or perceived flaws in their physical appearance (Phillips, 1996; Phillips et al., 2005b; Phillips et al., 2005c). Abnormal brain activation patterns during encoding of global elements of faces and objects (Feusner et al., 2007; Feusner et al., 2010; Feusner et al., 2011) have been taken as additional evidence of an excessive processing of details in BDD compared to controls. Other investigations have attempted to ascertain behavioural evidence of detailed visual processing in BDD using various experimental paradigms. For instance, Stangier et al. (2008) showed an enhanced perception of changes in facial features in a non-clinical sample of female BDD sufferers, compared to healthy controls and dermatology patients without BDD, possibly suggesting a tendency towards detailed visual processing in BDD. Feusner et al. (2010) and Jefferies et al. (2012) both investigated the face inversion effect (FIE) in BDD. The FIE is defined as a decrement in performance for processing inverted versus upright face images and is considered as a classic 'signature' for holistic processing. A reduced FIE was observed, relative to healthy controls, during long stimulus presentations in these studies, possibly suggesting deficits in holistic processing in BDD. Interestingly, the reduced FIE was not evident during short stimulus presentations (500 ms) (Feusner et al., 2010). Caution is however needed when interpreting the results of both FIE studies.

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Methodological issues such as small sample sizes, learning/practice effects from not counterbalancing the order of conditions, and the choice of stimuli (e.g. familiar versus unfamiliar face stimuli) may limit the generalizability of these findings. It is also unclear whether the reduced FIE in BDD is specific to faces or whether it holds to the same extent for objects, which would imply a general propensity to engage in highly detailed processing across all stimuli types (Yin, 1969).

Alongside these studies specifically testing detailed versus holistic processing, a number of other investigations assessed different aspects of visual information processing in BDD. Deckersbach et al. (2000), for instance, found female BDD participants to exhibit a disproportionate recall of details on the Rey Complex Figure Task; however, no significant impairments, or excessive focus on details, emerged in the copy accuracy condition. The authors interpreted these results as an indication of a non-verbal memory deficit, secondary to impaired strategic processing; yet, abnormalities in detailed processing accounting for these findings cannot be ruled out. In a study investigating the ability to discriminate facial features, BDD participants were found to be as accurate as OCD patients and healthy controls at recognising faces on the Benton Facial Recognition Test (BFRT) (Buhlmann et al., 2004). Similarly, when assessing the ability to detect subtle differences in symmetry of others' faces, individuals with BDD did not exhibit enhanced visual skills for symmetry compared to OCD patients and healthy controls (Reese et al., 2010). As face recognition and symmetry detection can include elements of both holistic and detailed processing, it is unclear to what extent individuals with BDD relied on detailed processing to attain the same outcomes as controls on these tasks.

Overall, it remains unclear whether the excessive focus on details in appearance and feature-based processing in BDD are a result of a failure of holistic perceptual processes. Further research is needed to evaluate the intactness of global/holistic processing in BDD, that is, the ability to integrate piecemeal information into a coherent whole. Behavioural phenomena, such as the face inversion effect (FIE), the composite face effect (CFE), and the global precedence effect (GPE), have been identified as the "signatures" or strong markers for holistic visual processing. These are well-established, robust, and related tasks capable of identifying deficits in holistic processing in other neuropsychiatric disorders such as prosopagnosia, autism and schizophrenia (Teunisse and de Gelder, 2003; Behrmann et al., 2005; Le Grand et al., 2006; Duchaine et al., 2007; Bookheimer et al., 2008; Butler et al., 2008). The present study aimed to use these paradigms to examine whether the over focus on details in appearance in BDD is attributable to a specific impairment in global processing. Based on the studies suggesting an excessive reliance on, and processing of, details (Feusner et al., 2007; Stangier et al., 2008; Feusner et al., 2009; Feusner et al., 2010; Feusner et al., 2011; Jefferies et al., 2012), we predicted impaired holistic visual processing in BDD. While the inversion face task has been previously tested on a BDD sample (Feusner et al., 2010; Jefferies et al., 2012), to the best of our knowledge, no previous studies have investigated the composite face effect or the global precedence effect in BDD.

2. Methods

2.1. Participants

Participants consisted of 25 subjects with a primary diagnosis of BDD and 25 healthy controls with no history of Axis I psychiatric disorders. BDD participants were recruited from a specialist BDD clinic at the Maudsley Hospital (London, UK) and a support group for people with BDD. Healthy controls were recruited via the university's volunteer database and circular emails sent to members of staff. The two groups were matched with respect to age, gender and years of education (Table 1). All BDD participants met diagnostic criteria according to the Structured Clinical Interview (SCID) BDD Diagnostic Module (Phillips et al., 1995) and were required to have a score of 24 or higher on the Yale-Brown Obsessive-Compulsive Disorder Scale modified for BDD (BDD-YBOCS) (Phillips et al., 1997). Seventeen of the BDD participants met criteria for an additional Axis 1 diagnosis, namely: major depressive disorder (MDD;N=15), generalized anxiety disorder (GAD;N=3), social anxiety disorder (N=1), and/or dysthymia (N=1). Over 80% (N=22) of the BDD sample reported facial features as their primary concern with appearance. The mean age of BDD onset was 15.8 years (S.D.=5.6). Regarding current treatment, 10 of the BDD participants were taking antidepressant medication at the time of the study. The participants were either not currently receiving psychological treatment or were about to begin a course of CBT for BDD.

Table 1
Demographic characteristics (mean and standard deviations) of the BDD and control groups.

	Controls (*N*=25)	BDD (*N*=25)	*p* value*
Age	30.4 (9.4)	29.4 (7.5)	0.68
Gender	16 F, 9 M	14 F, 11 M	0.56
Education	16.9 (1.6)	15.9 (1.9)	0.05
BDD-YBOCS	–	32.7 (3.9)	–
HADS	3.4 (2.8)	20.4 (8.5)	< 0.01

Abbreviations: BDD, body dysmorphic disorder; BDD-YBOCS, BDD version of the Yale-Brown Obsessive-Compulsive Disorder Scale; HADS, Hospital Anxiety and Depression Scale. *Based on *t*-test and χ^2 test analyses.

2.2. Experimental tasks

2.2.1. Inversion task

The face inversion effect (FIE) refers to a drop in performance for recognition of inverted versus upright faces as shown in healthy controls (Yin, 1969). Specifically, inversion disrupts holistic face processing, resulting in feature-based strategies to be employed and a decrease in performance for accuracy of recognition and response latencies. In the presence of deficits in holistic processing, we expect inversion not to affect performance (i.e. we expect a weak FIE).

The stimuli consisted of faces and houses, differing in terms of features (e.g. eyes, mouth, doors, or windows) or spacing between features (e.g. spacing between nose and eyes) (Yovel and Kanwisher, 2004). The face stimuli were created from a grey-scale photograph of a male face (see Yovel and Kanwisher, 2004 for more details on the original paradigm). The task involved four separate conditions (upright face, inverted face, upright house, inverted house), containing a total of 80 randomized part and spacing trials, the order which was counterbalanced. Specifically, pairs of upright or inverted stimuli, consecutively presented for 250 ms each (in line with Yovel and Kanwisher, 2004 pilot study), appeared on the computer screen, separated by a 1000 ms inter-stimulus interval. The experiment involved indicating as rapidly and accurately as possible whether the two stimuli were the same or different via a key press; each block included 40 randomized trials of identical faces (i.e. same trials) and 40 non-matching trials (i.e. different trials). Viewing distance was 50 cm, with faces subtending $5.1^\circ \times 8^\circ$ of visual angle and houses subtending $8^\circ \times 8^\circ$ of the visual angle. Accuracy rates (percent correct) and mean reaction times were recorded for analyses.

2.2.2. Composite task

The composite face effect refers to a difficulty in matching top face halves when aligned/ fused with different bottom halves, as opposed to when they are misaligned, presumably due to holistic mechanisms instantly forming a new facial configuration (Young et al., 1987). In individuals with a propensity towards detailed visual processing, less interference from alignment is expected. The task (Le Grand et al., 2004) consisted of two counterbalanced blocks: an aligned condition, whereby the top and bottom segments of faces are aligned (subtending $11.2^\circ \times 15.9^\circ$ of visual angle from a distance of 50 cm) and a misaligned condition, in which the top face half is misaligned from the bottom segments ($16.7^\circ \times 15.9^\circ$ from a distance of 50 cm). Face stimuli were gray-scale digitized images of adult male and female Caucasian faces. Each block contained 48 trials, of which 24 comprised identical top halves (i.e. "same trials") while 24 were non-matching stimuli (i.e. "different trials"); the bottom halves of the faces were always different. The procedure involved presenting pairs of faces sequentially for 200 ms, separated by a 300 ms inter-stimulus interval. Participants indicated via key press if the top halves of the two faces were the same or if they were different, as quickly and as accurately as possible. Accuracy rates and reaction time were recorded for statistical analyses.